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Safety integrity level verification for safety-related functions with security aspects

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Highlights

- Verification safety integrity level process with the cyber security aspects.
- Verifying safety integrity level with the cyber security factor is difficult and it is currently a challenging issue.
- Safety & cyber security aspects consist of different group of functional requirements.
- Integrated safety & cyber security analysis can minimize too optimistic results.
- In verification SIL the result of security analysis is affecting uncertainty of probabilistic model parameters.

Abstract

The article is devoted some important issues of the functional safety analysis, in particular the safety integrity level (SIL) verification of safety functions to be implemented within the distributed control and protection systems with regard to cyber security aspects. The procedure for functional safety management includes hazard identification, risk analysis and assessment, specification of overall safety requirements and definition of safety functions. Based on risk assessment results the safety integrity level (SIL) is determined for consecutive safety function. These functions are implemented within industrial control system (ICS) that consist of the basic process control system (BPCS) and/or safety instrumented system (SIS). Determination of required SIL related to required risk mitigation is based on semi-quantitative evaluation method. Verification of SIL for considered architectures of BPCS and/or SIS is supported by probabilistic models with appropriate data and model parameters including cyber security-related and uncertainty aspects. A method based on quantitative and qualitative information is proposed for SIL verification with regard of the evaluation assurance levels (EAL), the security assurance levels (SAL) and the number of protection rings described in the SeSa methodology. A method for SIL verification, based on so called differential factor is presented.

Keywords

Safety integrity level, integrated functional safety & cyber security, differential factor

1. Introduction

Nowadays the internal and external communication channels are more and more extensively used in technical systems and especially industrial control system (ICS). They improve their functionality but can deteriorate the safety and security if not properly designed and operated. From practical point of view it is necessary to integrate the safety and security aspects. In the paper the classification of computerized systems is proposed as the starting point for further functional safety and security analyses.

Functional safety, which is a part of overall safety, is aimed at reducing the risk of a hazardous system operating to an acceptable or tolerable level by introducing a set of

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